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ABSTRACT

The development of new technology for education raises the question of control. Large corporations have entered the education field. They view the reluctance of some educators to commit themselves to the new media as a sign of fear of change. Educators who hold humanistic views of the learning process criticize the regimentation and regulation necessary to the new technology. Certain factors inherent in the educational system tend to prevent a take-over by the educational business technologists, but these same factors do not also assure the adequate assessment of materials to insure the use of the many valuable aids which are being developed. An independent "consumer's union" would be a valuable aid in evaluating some of the potentially revolutionary techniques; so would more adequate teacher training in the philosophy of various technologies. In-service training, which has long been an under-valued tool, could help to up grade the knowledge of present teachers about educational technology and thus made them more able to evaluate techniques for their own use. (JY)

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Technology and Education: Who Controls?

by Theodore R. Sizer and David L. Kirp*

The new educational technology[1] is not an end in itself, worthy of encouragement for its own sake; it is a means of effectively carrying out educational ends independently fixed by those whose central concern is the education of children. In the context of "control" of education, this suggests that the best hedge on the possibility of supplier-dominated education is not the technologists' self-checking process, but rather the creation of a new force, an independent "consumers' union" for education which would test and evaluate all materials. In the context of the training of teachers, the understanding and intelligent use of technology as a means, rather than an end in itself, can best be maintained by including exposure to the new technology as part of substantive courses, so that the technology will serve the objectives of instruction, providing new ways of reaching those objectives.

Policy questions about the relationships between education and the new technology are essentially questions about control. The technology itself is neither monster nor miracle worker, but merely an aid (like blackboards and books). Used properly, that tool can assist teachers and school systems to accomplish what they deem should be done; used improperly, the tool can become an end in itself, subverting the legitimate aims of education.

Presently, the suppliers of educational goods and services exert a large and perhaps unhealthy influence on that market. The recent entrance of industrial giants into that market, viewed in light of their conduct

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1 "New technology" refers to recently developed equipment designed to facilitate some aspect of learning (and teaching); it includes programmed materials, television, motion pictures, computer-aided instruction, information retrieval systems, etc.

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thusfar, raises the unhappy spectre of an educational oligopoly, dominated by companies interested primarily in short-range profits, not longer-range, research-supported contributions to education. While the diffuseness of the public education "system" provides some safeguards against takeover by the technocrats, the capacity of public education to evaluate new materials, and thus to have a voice in the creation of those materials, remains limited. This paper recommends the utilization of state and regional evaluation centers, and it strongly urges the creation and public support of a non-profit, independent consumers' union for education, which would shift control back to the educators.

In training teachers in the new technology, technological competency, the capacity to understand the relationship of technology to all aspects of learning, and not mere mechanical know-how should be stressed. Existing "audio-visual aids" courses, which consider the technology apart from the curriculum courses and child development courses, fail to meet this need, and for other reasons are likely to be distrusted by teachers and school systems. New approaches to teacher training (both in-service and pre-service) which undertake to relate the technology to learning processes are needed.

I. The Conventional Wisdoms

The conventional wisdom is of two minds concerning the impact of technology on education. To some (including, but not limited to, those engaged in developing technological applications) technology is a miracle worker, capable of remaking education in its own benign image:

> One can predict that in a few more years millions of school children will have access to what Philip of Macdeon's son, Alexander, enjoyed as a royal prerogative: the personal services of a tutor as well-informed and responsive as Aristotle.[2]

The variety of available technology is cited as proof of its value:

> Recent technological aids to individualization include magnetic tapes, microfilms, and teaching machines. Programmed instruction offers a rich new supply of materials designed for independent study. Computer based instruction, now in early phases of development, will allow highly individualized learning. Dial-selection systems offer another valuable approach to independent study. Newly developed facilities -- carrels, seminar rooms, and learning resources centers -- contribute valuable settings for the conduct of individualized instruction. Computer based record systems are being developed that will offer vastly improved means of analyzing, storing, and retrieving information about individual students. Computers are also being used to accomplish individualized scheduling in high schools...[3]

To those who adopt this position, the sources of resistance (generally, teachers) represent traditionalism at its most dangerous.[4] The technologists attempt to reckon with these sentiments by reassuring the teacher that:

> ...these devices are surely /his/ liberator...their capacity to learn is nearly infinite, and they never forget. Also, they never get tired, they never lose patience, and they never look askance and embarrass the somewhat slower student.[5]

The teacher, however, reads the description and is far from reassured; the machine appears to be ever so much less fragile than he or she is. For this

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2 P. Suppes, "The Uses of Computers in Education," Scientific American, (Sept. 1966), 218-219.

3 G. Heathers, "Individualized Instruction," U.S. Congress, Senate Committee on Labor and Public Welfare. Subcommittee on Education. Notes and Working Papers Concerning the Administration of Programs Authorized Under Title III of Public Law 89-10, The Elementary and Secondary Education Act of 1965 as Amended by Public Law 89-750. (Washington, D.C.: Government Printing Office, April, 1967), Ch. 7, Sec. B, pp. 177-178.

4 In his thoughtful essay, The Teacher and the Machine, (Pittsburgh: The University of Pittsburgh Press, 1967), Philip Jackson cites studies of teachers' opposition to technological aids.

5 "Technology in Education," (Washington, D.C.: National School Public Relations Association, 1967), p. 5.

continued unwillingness to seize the technological day, the teacher is scolded, accused of fearing change.

> /Administrators and faculty/ are comfortable in the existing framework and prefer the status quo. The effective use of media raises curriculum and evaluation questions that are not only difficult to answer, but the responses also shatter major assumptions....[6]

To others, the technological invasion of education is to be resisted, not because of fear of loss of jobs or unwillingness to alter seemingly fixed patterns of instruction, but out of concern for the survival of human values. They shudder when they learn of an "individualized" learning that leaves no room for happenstance, but rather guides a student from one predetermined point to another, as programmed instruction materials typically do. James Ridgeway, doing research for a piece on the "Computer-Tutor," reported on his dialogue with a history-programmed computer:

> The computer asked, "A legend connects Betsy Ross to George Washington; according to the story what did Betsy Ross do?"
> "I do not know."
> "Try again, making your answer an affirmative statement."
> "Betsy Ross made flags."
> "Whose flag? Which flag?"
> "She made U.S. flags."
> "The U.S. flag did not exist as such until after 1870. This legend refers to an earlier period. Whose flag? Which flag?"
> "She made American flags."
> Then the computer began to give hints:
> "She made -- -- American flag. Try again."
> "She made the first American flag."
> "Right, she made the first American flag."[7]

Nor are educators mollified by the clever computer that learns the name of its tutee, and greets him with "hello, Johnny," rather than with the less personal "hello, X." They are concerned with the subtle effects of a

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6 "Expert Answers to Urgent Ques..ons," College Management (Oct. 1968),pp. 17-18.

7 "Computer-Tutor," The New Republic, (June 4, 1966, pg. 20).

child's dependence on a machine for answers, and for the formulation of questions, on his ability to cope with individuals and communities.

At its most simplistic, this position represents intellectual Ludditism: destroy the machines. Yet in its most responsible form the position does pose crucial problems of personal identity, and of control, that need to be faced up to in coming to terms with the technology. The educator's concern about control has, at its best, a moral basis. This concern is ideological, not necessarily measured in changing school structures or changing market patterns. The educator typically regards himself as charged with the task of conveying ideas, principles, values that are essentially human and democratic; indeed, he may well view education as concerned principally with the transmission of these values, rather than with the speedy and efficient conveyance of a fixed body of knowledge.

> We like to believe [that in the "human-based school"] children and youth are inducted into their culture; individual potentialities are identified and developed; individuals take on a sense of identity and ultimately transcend themselves; and the young are inculcated in those values that make for the ideal adult.[8]

Frequently, the technocrat appears a threat to this set of values, one who by running schools more effectively (however measured) than the educator has in the past will seduce those who ultimately fix the educational priorities into viewing education as understandable from a systems-analytic viewpoint.[9]

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8 J. Goodlad, "The Future of Learning and Teaching," AV Communication Review XVI (Spring, 1968), p. 6.

9 This moral concern arises whenever technology may have an impact on policy: "...the people who occupy leadership positions in management can hire technologists. But often they are not able to transfer to them the fabric of their values. It is becoming difficult to continue the apprenticeship of wisdom that normally flows between the man who manages and the technologist. The manager may feel that his outdated technical training is inadequate and this fear may be communicated in the transmission of his values as manager to those next in line. It is essential that the non-scientist stop worrying about the gap between the two cultures and admit that there is a management of science." De Carlo, "Perspectives in Technology," in E. Ginzberg (ed.) Technology and Social Change (New York: Columbia University, 1964), p. 41. See also Raymond Callahan, Education and the Cult of Efficiency, (Chicago: University of Chicago Press, 1962) for a study of the effect of Taylor's "efficiency" movement in the early 20th century.

Much of this concern derives from the demands that the technologists make on those whom they ostensibly serve. They call for regularized procedures, for formulae that can be reduced to punch card codification. While such procedures are feasible -- and indeed may be necessary -- for the business inspired by a profit-motive, they are less appropriate when the end sought is something as nebulous as learning or growth. Yet the educator must be able to assert these latter goals if education is to permit freedom as well as formalism, serendipity as well as scientific method.

I. A. Richards has reminded us that we "are products of the assistance we can accept ... potential victims of those who, for whatever motives, would like to run things for us."[10] That victimization needs guarding against, especially as it relates to controls over educational goals. To the educator, technology should be regarded as means and not end. To let the technology define educational objectives -- whether these be in training teachers, in evaluating materials, or in whatever educational endeavor -- is to do a disservice both to the technology and to education. Carried far enough, it converts the school system into blank-check-writer, acquiescing in the gospel of gadgetry; it converts the teacher into tinkerer, one who starts up the equipment, and then waits for mechanical mishaps. The awesomeness of the technology demands a reassertion of human values, and human control. "The greatest intellectual challenge of our time is not how to design machines that behave more like humans, but rather, how to protect humans from being

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10 D. Bushnell and D. Allen (eds.), The Computer in American Education, (New York: Wiley, 1967), intro. xviii.

treated more and more like machines."[11]

II. The Education Market

The increased use of technology in education is seen by some educators as a move towards the "takeover" of education by "outsiders," the developers and suppliers of educational goods who are supposed to serve the educational system. The educators fear that technologists will occupy an ever-increasing role in influencing and making decisions about the educational enterprise. Such a concern about power, and about numbers (who will be doing what in education) upsets many. Writing in The New Republic, James Ridgeway describes in apocalyptic terms the ambitions of the ardent computerists:

> They want to design a school system, provide it with innovative materials and equipment, and then test the finished product -- in this case, the student as he comes out of one system and goes into another. The long-range thrust is toward making the computer into an effective teaching machine. If this can be done, the present school structure will radically change. It is conceivable that the school as we now know it will go out of existence altogether.[12]

The school today, of course, is profoundly influenced by those "outsiders" whom the educators fear. That they appear unaware of this influence is traceable to two factors: they don't see the textbook salesmen as "outsiders" and they are not as conscious as they might be of the influence of existing

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11 P. Jackson, The Teacher and the Machine, p. 66. Professors Ellis and Tiedeman have considered similar matters in discussing computerized guidance systems: "Because machines and human beings are different media, to expect one to act like the other is more like expecting a poet to literally paint a portrait with words. We must let the machine stay a machine, but recognize that the activity of counselling by human beings is a means to an end, this end being some desired condition in which the client will eventually find himself. Our interest thus centers on the possibilities of a machine achieving this same end even though it does so in a manner clearly different from human beings." "Can A Machine Counsel?" (unpublished paper, 1968).

12 J. Ridgeway, "Computer-Tutor," p. 19 (emphasis added).

teaching materials on the schools' program and on the childrens' capacity to learn. While it is difficult to ascribe effect in any scientific sense, it is reasonable to argue that the textbook and the workbook are the principal influence on the shape of the school program today. All too many teachers are ill-prepared to teach the subjects assigned them and thus are obliged to rely on the text as a crutch. Most teachers are overworked (those who deny it should spend six unbroken hours responsible for thirty-five lively ten year olds) and have to fall back on materials, often workbooks, to keep the children "busy." Most school syllabi are so vague as to be useless; the assigned texts determine in critical substantive ways what is taught. The "education business" has, in sum, a major influence on school practice today. To say that the new technologically-based industries are the first to threaten educators' autonomy is to avoid the obvious but usually overlooked facts of the situation.

Seen in this light, the recent entrance of new, large manufacturers -- large enough to package broad scale, multi-media programs -- into an already supplier-dominated market arouses real concern. In the mid-1960's, companies such as International Business Machines, Xerox, Radio Corporation of America, General Electric, Raytheon, and Sylvania (industrial giants all) acquired smaller educational materials outfits. At each of these occasions, there was talk of two sorts: of the debt that American industry owed to education, and of the vast untapped potential of the educational technology market.

These industrial giants do have the capacity to undertake the research and pre-marketing evaluation necessary to produce decent materials. As one writer, describing the trend two years ago declared:

> The companies now coming into the market have resources -- of manpower and talent as well as of capital -- far greater than the education market has seen before. They have, in addition,

> a commitment to innovation and an experience in management that is also new to the field.[13]

They also have the capacity -- the sales and promotional and fiscal resources -- to overwhelm the market with textbooks and technological gadgetry which provide more slickness than substance. The record of these companies over the past several years is discouraging: thusfar, many have stressed short-term profitability rather than long-range planning. Many companies have been unwilling to make substantial investments for basic research, preferring the surer and more immediate gains that come with almost-instant marketing of new products. While companies argue that the market structure makes industrial influence of a new and happy kind difficult to achieve, these companies have not moved to begin providing shopping lists of curricular materials of differing kinds -- related texts and films and tapes, and the exposure of teachers to those materials -- which would encourage thoughtful planning and selecting by the teacher in a subject area, but have instead produced a text or a film or a tape, to be plugged in at some arbitrary point in the progress of a course.[14]

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The education market is assuredly big: school expenditures for the 1966-67 school year were estimated at 48.8 billion dollars, making

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13 C. Silberman, "Technology is Knocking at the Schoolhouse Door," Fortune (August, 1966), pp. 120-121.

14 The structure and market power of the suppliers of educational materials has been inadequately studied. No one has seriously considered, for example, whether "the market" about which primary concern should be voiced is the "textbook market," the "science textbook market," "the biology textbook market," or some very different entity. The recent record described in the text suggests the need for careful study by economists, lawyers, and educators of the present state of the educational materials market, of recent trends in that market, and of particular aspects of that market where concentration appears particularly acute.

education the second biggest national market (just behind defense.)[15] Yet American public education is not really a single functioning "system" at all. There exist more than twenty thousand school districts, each of which operates almost wholly independently. On specific matters of school policy, control resides at various levels within the school districts. One organization, which sought to illustrate the advantages of the computer in performing administrative tasks in a school system, found that it should appeal directly to school superintendents; the P.S.S.C. course planners concluded that the physics teacher would have to be wooed as an individual, that no superintendent's directive could persuade him even to buy the P.S.S.C. materials, let alone to use them. This dispersion of power, and consequent difficulty of acquiring a position of control, is likely to increase. The political winds favor structural school decentralization, which will yield even more school districts to contend with, and, more radically, increasing community power in schools, which will require that the technologist seeking to market his products convince parents as well as educators that the item is worth trying out.

For other reasons, education seems peculiarly inhospitable to takeover by the industrial technocrats. There are difficulties of measurement, and of comparison of competing products. "Effectiveness" in education is not readily defined; alternative approaches are not really trying to accomplish the same end. And even if one way of doing something could be shown to be demonstrably "better," this doesn't guarantee its adoption. In this sense, analogies to other supplier-consumer markets, and the ways companies come to dominate those markets, may mislead. In the typical market situation,

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15 "Technology in Education," (Washington, D.C.: National School Public Relations Association, 1967).

the person buying the good is the one for whom increased efficiency will make a difference by making the good more obviously useful to him. Thus, appeals to the consumer can be couched in terms of enlightened self-interest. In education, however, the ultimate "consumer" is really the student; it is he who most directly benefits or suffers from the quality of goods and services that the school system buys. But this "consumer" has little or no influence on those who do the "buying," the professional educators and, to a lesser degree, the parents. The decisions by these surrogates for students are based in part on the students' needs, as these are perceived, but they are also based on political needs including the felt need to maintain a tradition of cautious action and, most critically, on financial realities.[16] These other factors may argue against using the very equipment that would most benefit the students, and the schools. At the worst, the "consumers' interest" is not in the hands of the true consumers at all, but in the hands of surrogates who fail to understand or give serious weight to the students' needs.

Centralization of some functions would doubtless be useful. Individual teachers, or individual schools, or even individual school districts -- the groups that presently make most of the ad hoc evaluations of new materials -- have neither the time nor resources to do that job effectively. Two innovations

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16 McCusker and Sorenson describe the economic characteristics of education as "(1) a high degree of labor intensity; (2) a low degree of specialization of labor; and (3) a low level of research and development activity." In the analysis of possible effects of new media it is anticipated that little change will occur during the next decade. They predict that education will "remain massive in size, diversive in form, complex in function, pervasive in effort, and conservative in nature." "The Economics of Education," in P. Rossi & B. Biddle (eds.), The New Media and Education: Their Impact on Society (Chicago: Aldine Pub. Co., 1966).

would be of particular value: (1) increased reliance by schools and school districts on state departments of education, and on regional school district associations, for testing and evaluating educational materials; (2) the creation of a consumers' union for education which would provide the forum for an independent evaluation of educational materials. Neither innovation would culminate in state-approved lists of, say, "social studies texts and films deemed appropriate for the sixth grade;" both would provide independent, detailed evaluation and comment on new materials. The schools' dependence on the suppliers for "evaluation" would be lessened and schools and teachers could exercise legitimate control in making more careful and intelligent choices about materials.

This latter entity -- a consumers' union for education -- is of especial importance and could represent an important new force in the political mix that "controls." The union could give evidence, often necessarily initial and incomplete evidence, but the best that there is at any rate, and such evidence would inform those making decisions about materials. The practice of asserting the "success" of a program or text because some "Nobel Laureate endorses it" would give way to assertions based on real data (data which that same Nobel Laureate has, presumably, been taught to respect in his own discipline). Such a consumers' union for education could not be supported in any way by industry; it would most likely have to be an independent non-profit corporation funded by the government, foundations, and cooperating school systems.[17]

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17 The "union contemplated here is similar in some ways to Educational Products Information Exchange (E.P.I.E.), a New York-based organization which publishes a monthly report providing specifications for the materials in a particular subject area. The proposed union would also provide critical evaluation of the materials, and would offer teachers and school districts individualized assistance, based on their own assessment of needs.

Reference to this idea has been made in the recent report, Innovation in Education, published by the Committee for Economic Development (New York: 1968), which proposes "the creation of a Commission on Research, Innovation and Evaluation in Education" (p. 70).

In sum, technology -- or the materials' "business" -- should be the servant of humane goals set for children by their parents, educators, and the community at large. This will only be possible if there is an effort to establish non-partisan assessments of materials. A "consumers' union" is an essential element in proper control.

III. The Training of Teachers

Linus: This "new math" is too much for me.
Lucy: You'll get on to it... It just takes time....
Linus: Not me...I'll never get on to it!
Linus: How can you do "new math" with an "old math" mind?

"On Adaptability," from Linus on Life

Technologists, amazed that teachers have not accepted machines that promise to reduce error, increase efficiency, hasten learning, and generally make education a rational process, complain of the paucity of training programs designed to acquaint teachers with the wonders of the new technology. Indeed, such programs are few: only a limited number of universities, U.C.L.A., Catholic University, and the University of Pittsburgh among them, have extensive course offerings in the field; many schools of education do not offer any exposure to the technology.

Even at those schools which offer some instruction in what is commonly called "audio-visual aids," that instruction is unsatisfactory. It is generally lumped into a single course taught at the end of the curriculum. Machines of increasingly byzantine complexity are wheeled into the classroom, and they are demonstrated; this is supposed to enable the teacher to operate a film projector without constantly splicing the film, or a tape recorder without erasing the day's lesson.

These "audio- visual aids" courses accomplish several ends, not all of

them intended. By having teachers operate actual equipment, they may reduce the teacher's fear of the machine; to that extent they are useful. However, such courses may limit a teacher's notion of suitable equipment, by stressing the presently available.

More significantly, the timing (and, indeed, the very existence) of separate audio-visual courses affords the teacher a notion of what the audio-visual is for: it is for show, for gimmickry, a device to be used to recapture flagging attention. Unlike books and blackboards (which are, after all, only other kinds of "aids"), audio-visual equipment is talked about as if it constituted a separate subject. It has nothing to do with science, or social studies, or language; applications of the technology are not explored in the curriculum classes. It has nothing to do with different learning processes; the technology is not discussed in child development classes. It has, in short, nothing to do with anything else; it occupies a marginal role in the teaching of teachers, mirroring what will be its marginal role in the teaching of children.

In learning about technology, the teacher needs to know more than how to turn on and off a battery of machines; he needs to acquire technological competence. While it is unlikely, and perhaps unnecessary, that he will fully understand the mechanics of the available tools (for that, trained specialists might well be more appropriate), his training should enable him to develop some sense of how technology bears on what he thinks he is doing as a teacher. With such a sense, he could determine what he needed in order to present material more effectively, what a machine might do that would be helpful. Armed with that understanding, he could intelligently negotiate for the sort of equipment that would suit his needs.

The central point, however, is that the training of the teacher must start with the objectives of instruction and with the means to reach those objectives. Novice teachers should be shown alternative teaching strategies, and in this context learn about the "technologies." The aids -- whether as simple as blackboards or as complex as computers -- follow from and depend on the objectives; they are part of the pedagogy related to the material being taught. That material and the objectives it addresses govern the choice and employment of the technologies, not vice versa.

The foregoing is obvious, but usually ignored. In industry, for example, there is evidence of more research and development in "hardware" rather than "software," on complete technological programs rather than resources to expand and support flexible and varied curricula. While it is often asserted that "technology follows the ends of education," there is little evidence that this is presently a governing factor. How much interest has the education industry, particularly the new technologically-based companies, shown in the ends underlying education? One cannot assume that there are givens, simply to be accepted and acted upon by industry. Technology shapes ends, in that it may make available new means: ends previously unreachable may now be within grasp.

Industry and education need closer ties, a recognition of the fact that materials follow objectives, and that constant interaction between teachers and material developers is therefore essential. Furthermore, teachers must be trained to see the importance of this interaction and to partake in it.

The need for technological competence compels teachers, and schools of education, to face up to many questions: questions involving the processes

of learning, and how any situation relates to those processes. About such matters much research also needs to be done, for precious little is understood. One can talk about "ordered procedures generated by and reflecting human intelligence,"[18] but the specifics of what those procedures might be, and how that intelligence is to be defined and measured, remain elusive. Faced with this lack of information about how learning happens, the teacher is not readily persuaded that the technician's stress on speed, efficiency, accuracy, and clear directions should prevail over the need -- presently unsatisfied by the technology -- to develop the student's confidence in his ability to determine goals.[19] As a study of "New Media Research in Teacher Education" concluded:

> Studying media in combination will improve our knowledge but will constitute only one step toward the most central and complex issue in the use of new media in teacher education: what can each device and combination of devices do best for different kinds of students, under different educational conditions, with respect to different educational objectives, and when used by different teachers? Obviously, no single medium or combination of media will accomplish the full job of training the teacher. No single criterion or set of criteria for successful teaching is likely to emerge, and no single best pattern for the training of all teachers is likely to be identified. In the same way, no single best pattern in the use of new media is likely to emerge as most effective under all instructional conditions.[20]

In-service training programs, as presently conceived, do not appear to offer substantial hope of awakening classroom teachers to the potential

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18 Ellis, Discussion of "Educational Technology: New Myths and Old Realities," Harvard Education Review, XXXVIII (Fall, 1968) (forthcoming).

19 Oettinger and Marks discuss the computer-programmers' claims regarding "individualized instruction" extensively in Chapter 4 of their forthcoming book, Run, Computer, Run.

20 Lesser and Schueler, "New Media Research in Teacher Education," AV Communications Review, XIV, (Fall, 1966), p. 352.

of the technology. Except when such programs are being offered for small numbers of teachers by a professional staff well versed in the uses and limitations of technology, their value has been marginal.[21] Companies have traditionally offered day or weekend-long programs to promote their own products, but this hardly equips the teacher to deal intelligently, and independently, with the technology. For this reason, public schools have not provided substantial financial support to such programs.

> In-service teacher training is the slum of American education... Public school systems have not been willing to make a significant financial commitment to in-service training and staff development activities... Colleges and universities have found offering courses for school teachers and administrators lucrative but have not allocated major financial or academic resources to the activity.[22]

Even when in-service training is available, it is more frequently viewed by the teacher as a way of satisfying state education requirements (and of making more money) than as an opportunity to become a better teacher.

> Teachers typically have seen in-service training as 'something somebody else does for us.' The policies and ground rules have been set by certification officials, school boards, school and college administrators. Typically teachers have docilely accepted both policies and offerings and have seldom even questioned the system.[23]

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21 This has generally been the history of training programs designed to explain new curricular materials, like P.S.S.C. physics, to teachers. The caliber of training has declined as the number of those being trained increased. For much curricular material, no teacher training at all is provided.

22 Davies, "Teacher Education," U.S. Congress, Senate Committee on Labor and Public Welfare, Subcommittee on Education. Notes and Working Papers Concerning the Administration of Programs Authorized Under Title III of Public Law 89-10, The Elementary and Secondary Education Act of 1965 as Amended by Public Law 89-750. (Washington, D.C.: Government Printing Office, April, 1967) Ch. 15, Sec. B, p. 295.

23 Davies, "Teacher Education," p. 297.

Schools may be reluctant to subsidize teacher training in educational technology for another reason. The schoolteacher trained in the new technology immediately becomes attractive to the many industries that use and develop similar equipment; these companies can offer salaries and working conditions to the technologically-trained teacher that public schools presently cannot match, and thus are able to lure him away from teaching. This tendency of the technologically competent to leave teaching has dissuaded many administrators from sending teachers to training courses that promise technological literacy.

One way of combatting this reluctance would be to give financial encouragement to school systems, enabling them to include on their staffs professionals who could develop programs which utilized the new technology, suggest equipment to classroom teachers, help evaluate new materials, etc. The availability of such positions might keep many of the technologically competent in the teaching profession, as well as provide school systems with personnel that understood the equipment that was available.[24]

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Conclusion

Any discussion of the policy implications inherent in the development of new technology for education raises questions of competing social values, questions of control. Properly understood, the technology can serve both as a way of accomplishing more successfully the independently-fixed goals of

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24 How such "media specialists" are to be trained poses another and very much open question. See V. Gerlach, "The Professional Education of the Media Specialist." AV Communication Review XIV (Summer, 1966), p. 185.

education, and as a way of broadening those goals by providing the capacity to accomplish the heretofore unaccomplishable. The advent of the new technology, and the training of teachers to technological competence, should be viewed in this light. This necessitates rethinking what learning is about, and how any technology, be it blackboard or computer, affects learning; reconsidering the structure of education, including the need for an independent force, a "consumers'union" to help in confronting and evaluating potentially revolutionary changes, of which the new technology is but one example.